

**UNCLASSIFIED**

| RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)      |        |        |         |         |         |       |  | DATE<br>February 2002 |                  |            |
|--|--------|--------|---------|---------|---------|-------|--|-----------------------|------------------|------------|
| APPROPRIATION/BUDGET ACTIVITY<br>RDT&E/Defense-Wide/BA 3 |        |        |         |         |         |       | R-1 ITEM NOMENCLATURE<br>Automatic Target Recognition<br>PE 0603232D8Z |                       |                  |            |
| COST ( <i>In Millions</i> )                              | FY2001 | FY2002 | FY 2003 | FY 2004 | FY 2005 | FY200 | FY 2007  |                       | Cost to Complete | Total Cost |
| Total Program Element (PE) Cost                          | 7.465  | 7.638  | 7.404   | 7.566   | 7.645   | 7.918 | 8.094  |                       | Continuing       | Continuing |
| ATR/P232   | 7.465  | 7.638  | 7.404   | 7.566   | 7.645   | 7.918 | 8.094  |                       | Continuing       | Continuing |

**(U) A. Mission Description and Budget Item Justification**

**(U) BRIEF DESCRIPTION OF ELEMENT**

(U)Automatic Target Recognition (ATR) systems improve the capabilities of our armed forces by enabling them to make better use of the information provided by such military sensor systems as radar, laser, infrared (IR), hyperspectral, identification friend or foe (IFF), and electronic signal measurement (ESM). ATR enhances the combat capabilities of our forces by increasing the lethality and survivability of our weapon systems and decreasing the time required to acquire and identify potential targets. ATR technology reduces our risk of fratricide by augmenting combat identification systems to improve our ability to distinguish between friend, foe, or neutral forces under high stress conditions. ATR technology provides significant workload reduction for the intelligence forces by aiding the image analyst to exploit imagery rapidly and accurately. In an era of decreasing military manpower, improved ATR will enable our forces to handle an ever increasing load of sensory information in the complex situations to be encountered in the military missions of the future. ATR capabilities are becoming essential to the Warfighter, as the Services pursue 'network-centric' concepts for exploiting sensor imagery and information acquired through large arrays of sensors at all echelons. Probability of target detection, recognition, and identification can be significantly increased while significantly reducing false alarm rates by exploiting multi-sensor fusion concepts for ATR algorithms.

**UNCLASSIFIED**

**UNCLASSIFIED**

| <b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>  |  | <b>DATE</b><br>October 2001 |
|---|--|-----------------------------|
| <b>APPROPRIATION/BUDGET ACTIVITY</b><br>RDT&E/Defense-Wide/BA 3 | <b>R-1 ITEM NOMENCLATURE</b><br>Automatic Target Recognition<br><b>PE 0603232D8Z</b> |                             |

(U) Increasing ATR operational effectiveness requires research and development to enhance sensors and algorithmic image processing. Additionally, improved, more efficient procedures must be developed for measuring and demonstrating ATR effectiveness. This is very important as the utility of ATR is highly dependent on the quality of the information provided by the sensor system(s) and the ability to process that information effectively to provide reliable decisions with operationally acceptable false alarm rates. Service and Agency ATR efforts have concentrated on algorithm development for conducting post-processing comparison and decision making which exploit improved digital computational capability. This program will focus on determining effectiveness of ATR, establishing benchmark metrics, and conducting and collecting single and multi-sensor data for potential reuse in Service and Agency algorithm development and objective evaluation. Consistent with the 1997 report of the Defense Science Board Task Force on ATR, this program will establish standard tests and procedures to provide an 'honest broker' assessment of current leading candidate ATR's, as well as emerging ATR technology for the next generation of ATR systems.

(U) The ATR program funds the integration and demonstration of advanced technology for field experimentation and assessment. The result of the ATR program efforts is the integration of the demonstrated technological capabilities and the capability to assess algorithms and various technologies. This leads to greatly improved understanding of the Joint Warfighting utility when assessed in realistic operational contexts. The Military Services provide air, land, and naval technological superiority, respectively, and ACTDs rapidly prototype and transition technological solutions to specific threat scenarios. This program provides timely resources and flexibility to horizontally integrate technology solutions across Services and Agencies and identify new and emerging ATR systems with confidence so that this critical technology can be fielded more quickly.

**UNCLASSIFIED**

**UNCLASSIFIED**

|   |  |  |  |  |  |  |  |  |  |                             |  |
|---|--|--|--|--|--|--|--|--|--|-----------------------------|--|
| <b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>  |  |  |  |  |  |  |  |  |  | <b>DATE</b><br>October 2001 |  |
| <b>APPROPRIATION/BUDGET ACTIVITY</b><br>RDT&E/Defense-Wide/BA 3 |  |  |  |  |  |  |  | <b>R-1 ITEM NOMENCLATURE</b><br>Automatic Target Recognition<br><b>PE 0603232D8Z</b> |  |                             |  |

| <i>COST(In Millions)</i>           | FY 2001 | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 |  | Cost to Complete | Total Cost |
|------------------------------------|---------|---------|---------|---------|---------|---------|---------|--|------------------|------------|
| Total Program Element (PE)<br>Cost | 7.465   | 7.638   | 7.404   | 7.566   | 7.645   | 7.918   | 8.094   |  | Continuing       | Continuing |
| ATR/P232                           | 7.465   | 7.638   | 7.404   | 7.566   | 7.645   | 7.918   | 8.094   |  | Continuing       | Continuing |

(U) **Project Number and Title: P232 ATR**

(U) **PROGRAM ACCOMPLISHMENTS AND PLANS**

(U) **FY 2001 Accomplishments:**

(U) Robustness of selected ATR's was assessed over a wider range of challenging operating conditions using innovative applications of real, hybrid and synthetic imagery. The first DoD-wide "Problem Sets" were created for government/industry/academia evaluation of SAR ATR performance in a benchmarking exercise conducted/led by AFRL. This effort provided the basis for the creation of a DoD-wide standard procedure for the development and use of expanded Problem Sets for SAR, EO/IR, LADAR, and Hyperspectral sensor/ATR evaluations. The Problem Sets and DoD standards for submission, review, approval, and use of Problem Sets have been posted on the Virtual Distributed Laboratory (VDL) website and distributed to the government and industry community. The application of such multi-sensor synthetic imagery in High Level Architecture (HLA) simulations was assessed as a technique to determine ATR effectiveness dynamically. In the hyperspectral area, an end-to-end performance model, incorporating sensor and processor models, was validated. The end-to-end model was used to conduct performance and subsystem trade off analyses between hyperspectral sensors and their ATR's. Service models developed to predict ATR performance were refined to include evolving high fidelity multi-mode sensors. An initial assessment of sensor fusion for ATR was conducted by the services reported at a DoD-wide technology review. This will pave the way for further work in refining network-centric sensing and ATR processing using sensor fusion algorithms and advanced architectures for information fusion to reduce false alarms and increase situational awareness. (\$ 7.465 million)

**UNCLASSIFIED**

**UNCLASSIFIED**

| <b>RDTE&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>  |  | <b>DATE</b><br>October 2001 |
|--|--|-----------------------------|
| <b>APPROPRIATION/BUDGET ACTIVITY</b><br>RDTE&E/Defense-Wide/BA 3 | <b>R-1 ITEM NOMENCLATURE</b><br>Automatic Target Recognition<br><b>PE 0603232D8Z</b> |                             |

**(U) FY 2002 Plans:**

(U) Building on the database from sensor data collected during FY01, algorithms will be benchmarked for detection and false alarm performance. A major new data collect, involving the Services, DARPA, and NASA, will be pursued. This data collect will take place over a 2-year period and will be conducted in a variety of terrains, seasons and weather conditions, involving fielded and advanced developmental sensors covering the broad electromagnetic spectrum (RF, Vis/NIR/MIR/FIR, LADAR, multi and Hyperpectral) for a wide variety of targets employing the latest CCD techniques. New Problem Sets for EO/IR, LADAR, and Hyperspectral sensor data will be created and submitted for evaluation by the ATR community. Continuing with the sensor fusion initiative, technical emphasis will continue to be focused on assessment of emerging ATR algorithms based on multi-sensor inputs. Using the nodes established in FY01 at AFRL and NVESD, performance results and raw data will be distributed and analyzed using the Virtual Distributed Laboratory (VDL). High Performance Computing assets will be incorporated to allow faster access and shorter algorithm processing cycles. The role of synthetic and hybrid data will be expanded in FY02 by comparing ATR algorithm performance for measured vs inserted targets. Hyperspectral databases will be expanded and enhanced using Forest Radiance II and Desert Radiance III data. Hyperspectral ATR performance predictions will be demonstrated. In the ATR transition area, additional IR problem sets will be collected and scoring and analysis methods for moving vehicles will be completed for LRAS3. LADAR algorithms will be demonstrated and evaluated. Mid-wave IR tests will also be conducted. (\$ 7.638 million)

**UNCLASSIFIED**

**UNCLASSIFIED**

| <b>RDTE&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b> |  | <b>DATE</b><br>October 2001 |
|---|--|-----------------------------|
| <b>APPROPRIATION/BUDGET ACTIVITY</b><br>RDT&E/Defense-Wide/BA 3 | <b>R-1 ITEM NOMENCLATURE</b><br>Automatic Target Recognition<br><b>PE 0603232D8Z</b> |                             |

**(U)    FY 2003 Plans:**

(U) Continue sponsroship, along with Service/DARPA investments (to include NASA), of a major data collect to support a DoD-wide, advanced evaluation of single and multi-sensor fusion techniques, including SAR, EO/IR, LADAR, Hyperspectral Imaging on single and multi-platforms. Targets, scenarios and background clutter will be representative of multiple battlefield conditions for a wide variety of user applications. Advanced Problem Sets will be created for DoD-wide, ATR assessments and will be posted on the VDL for use by the government, industry, and academia. Continue advanced assessment of sensor fusion techniques for enhanced ATR. (\$7.404 million)

**UNCLASSIFIED**

**UNCLASSIFIED**

|   |  |  |
|---|--|--|
| <b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>  |  | <b>DATE</b><br>October 2001  |
| <b>APPROPRIATION/BUDGET ACTIVITY</b><br>RDT&E/Defense-Wide/BA 3 |  | <b>R-1 ITEM NOMENCLATURE</b><br>Automatic Target Recognition<br><b>PE 0603232D8Z</b> |

| <b><u>(U) B. Program Change Summary</u></b>                       | <b><u>FY 2001</u></b> | <b><u>FY 2002</u></b> | <b><u>FY 2003</u></b> | <b><u>Total Cost</u></b> |
|---|-----------------------|-----------------------|-----------------------|--------------------------|
| Previous President's President's Budget Submission                | 7.534                 | 4.673                 | 7.424                 | Continuing               |
| Delta   | (0.069)               | 3.043                 | 0.164                 | Continuing               |
| FY 2002 Amended President's Budget Submission                     | 7.465                 | 7.716                 | 7.588                 | Continuing               |
| Appropriated Value  | 7.534                 | 7.716                 |                       | Continuing               |
| Adjustments to Appropriated Value                                 |                       |                       |                       |                          |
| a. Congressionally Directed Undistributed Reduction               | 0.000                 | (0.078)               | 0.000                 | Continuing               |
| b. Rescission/Below-threshold Reprogramming, Inflation Adjustment | (0.069)               | 0.000                 | 0.000                 | Continuing               |
| c. Other  | 0.000                 | 0.000                 | (0.184)               | Continuing               |
| Current FY 2003 Budget Submission                                 | 7.465                 | 7.638                 | 7.404                 | Continuing               |

**Change Summary Explanation:**

(U) **Funding:** FY 2001 reductions reflect Section 8086 adjustments.

(U) **Schedule:** N/A

(U) **Technical:** N/A

**UNCLASSIFIED**

UNCLASSIFIED

| RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)      |  | DATE<br>October 2001 |
|--|--|----------------------|
| APPROPRIATION/BUDGET ACTIVITY<br>RDT&E/Defense-Wide/BA 3 | R-1 ITEM NOMENCLATURE<br>Automatic Target Recognition<br>PE 0603232D8Z |                      |

(U) C. Other Program Funding Summary Cost: N/A

(U) D. Acquisition Strategy: N/A

(U) E. Schedule Profile: N/A

UNCLASSIFIED